American Nuclear Society

Position Statement #44

Nuclear Energy's Role in Climate Change Policy

The American Nuclear Society (ANS) supports performance-based and technology-inclusive standards in clean energy policies that seek to preserve the environment and improve people's lives. Such policies should encourage market signals to drive development of low-cost, clean energy technologies that will be adopted globally. As one of the largest global sources of clean energy,[1] nuclear energy has played and should continue to play a significant role in displacing emissions through increased electrification and expansion into sectors (e.g., industrial and transportation) besides electricity. ANS supports policies such as

- tax credits for existing and future advanced clean energy technologies,
- technology-inclusive clean energy standards,
- market solutions to increase reliance on clean energy (e.g., carbon pricing),
- incentives that support deployment of integrated clean energy systems in traditionally nonelectricity or nonnuclear markets (e.g., district heating, desalination, variable generation, hydrogen production, and industrial processes),[2] and
- advanced nuclear technology demonstration and deployment.

ANS supports policies that are designed to maintain and expand the role of nuclear energy in future clean energy generation and believes that such policies are vital in addressing climate change in an effective and economically achievable manner.

Background

The consensus of the international community of climate scientists is that humans are influencing the global climate.[3] The U.S. government and foreign governments have made commitments to decarbonize by reducing emissions of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane, and other pollutants that contribute to climate change.[4] ANS recognizes that it will be a challenge to reduce reliance on fossil fuels, which are now the primary source of energy (oil, gas, and coal accounted for over 80% of the global primary energy usage in both 2010 and 2019),[5] especially given that energy demand is expected to increase by nearly 50% from 2020 levels by 2050.[6] In order to achieve deep decarbonization, increased growth in energy production from clean sources, like nuclear energy, will be paramount. International agreements to reduce climate change impacts that serve as successors to the landmark Paris Agreement[7] will need to be expanded and strengthened if the increasingly negative consequences of climate change are to be mitigated. Nuclear energy's valuable role in reducing GHG emissions can be seen in a 2018 Intergovernmental Panel on Climate Change report,[8] in over half of the scenarios that have a 50% chance of limiting warming in 2100 to 1.5°C.[9]

The Paris Agreement established an international goal of keeping global temperature rise well below 2°C compared to preindustrial levels. Most experts agree that limiting GHG emissions is necessary to achieve this goal[10]; however, there is no existing consensus on how to achieve it. Various studies have demonstrated the vital role nuclear energy can play in reducing GHG emissions, including the International Atomic Energy Agency's *Nuclear Energy for a Net Zero World*,[11] in which nuclear energy is shown to be essential

to global clean energy production via safe extension of the operational lifetimes of existing nuclear power plants and addition of approximately 550 GW of new nuclear capacity by 2050. This and other studies find that nuclear energy is an ideal complement to wind, solar, and storage in clean electricity scenarios, dramatically reducing overall system costs when compared with decarbonizing using renewables and storage alone.[12,13] In addition, initiatives such as the Nuclear for Climate Initiative[14] have called for nuclear to have an increased role in decarbonization, while various professional societies associated with nuclear, including ANS, have joined voices calling for an expanded nuclear role in the Declaration from Nuclear Societies.[15]

In 2020, nuclear supplied 5% of the world's energy,[16] and, according to the International Energy Agency (IEA), the use of nuclear power has prevented more than 60 gigatonnes of carbon dioxide emissions over the past 50 years. In its report *World Energy Outlook 2021*, the IEA identifies a "net-zero emissions by 2050" scenario that calls for nuclear power capacity to almost double by 2050.[17] Replacement of existing fossil-fuel power plants with clean energy sources, like nuclear, will be paramount in the effort to reduce emissions while stimulating economic expansion, supporting the growth of nations, and achieving progress on climate goals. For example, the siting of an advanced sodium-cooled reactor at a retired coal power plant site in the state of Wyoming[18] and the agreement to repurpose coal plants with small modular reactors in Romania[19] will help to reduce emissions while providing local economic benefits. Nuclear energy's contribution goes beyond decarbonization, as described in a report on how nuclear energy and nuclear technologies contribute to achieving each of the United Nations Sustainability Goals.[20]

In the U.S., nuclear energy accounts for about 20% of total electricity production[21] and about half of all the clean energy consumed (nuclear energy consumption in 2020 exceeded all the energy consumed by geothermal, wind, solar, and hydroelectric sources combined).[22] Nuclear power has been the single largest source of clean electricity production in the U.S. for several decades,[23] despite premature closures of facilities caused by economic and market factors that don't value the attributes of nuclear energy.[24] Natural gas generation and electricity imports have largely replaced these prematurely closed nuclear assets (e.g., in Vermont[25,26] with the closure of Vermont Yankee in 2014, in California[27] with the closure of San Onofre Nuclear Generating Station-2 and -3 in 2012, in Florida[28] with the closure of Crystal River in 2012, and in New York[29] with the closure of Indian Point-2 and -3 in 2020 and 2021), resulting in net losses in clean energy production. To avoid premature closures, several states (e.g., Illinois, New Jersey, New York, and Connecticut) have enacted policies that compensate nuclear power plant owners/operators for their positive environmental impact.[30]

ANS has developed a "Nuclear in the States Toolkit" that outlines actions that support nuclear energy's role as the U.S.'s primary clean energy source.[31] Furthermore, as described in ANS Position Statement #26, U.S. nuclear power plants provide reliable clean energy, help diversify our electricity supply, and support continued U.S. influence over global safety and nonproliferation standards.[32] As the U.S. and other nations work to increase reliance on clean energy sources, nuclear energy is poised to grow its service in electricity markets and expand into untraditional markets (e.g., hydrogen production) that can lead to reduced emissions from the industrial and transportation sectors.

In 2019, having shut down all but seven of its 17 nuclear reactors and despite commitments to increase renewable capacity, Germany released three times the amount of CO_2 per unit energy produced than did France, which has a large fleet of nuclear reactors.[33] In addition, the average residential electricity price in Germany for the first half of 2021 was the highest in the European Union, over 150% higher than in the U.S. and over 60% higher than in France (which is below the average for the European Union).[34] This demonstrates France's ability to produce baseload power using nuclear energy that results in GHG emissions on a per capita basis [6.8 million metric tons CO_2 equivalent (MMTCDE) per capita] that are below the European Union's average (8.4 MMTCDE per capita), whereas Germany's use of renewables backed up by fossil fuels results in GHG emissions (10.1 MMTDCE per capita) among the highest in the European Union.[35]

Policies to address climate change must be economical, practical, and effective. Studies show that steep GHG emission reduction cannot be achieved economically solely through intermittent renewables and energy storage.[36] Reliable, available, clean energy sources like nuclear power must have a growing share of the global energy supply if climate goals are to be achieved. As the U.S. and other nations work to reduce emissions, they must adopt policies that consider the clean, reliable, and affordable attributes of nuclear energy.

References

1. International Energy Agency. *Nuclear Power in a Clean Energy System*. May 2019. https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system (current as of Jan. 25, 2022).

2. American Nuclear Society. Position Statement #43: "Nuclear Technology's Critical Role in the World's Future Energy Supply." August 2019. https://cdn.ans.org/policy/statements/docs/ps43.pdf (current as of Jan. 25, 2022).

3. Intergovernmental Panel on Climate Change. *Climate Change 2021: The Physical Science Basis: Summary for Policymakers*. Section A.1, p. 4. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf (current as of Jan. 25, 2022).

4. Framework Convention on Climate Change. Conference of the Parties serving as the meeting of the Parties to the Paris Agreement. Third session. Agenda item 2(c). "Organization of work, including for the sessions of subsidiary bodies." FCCC/PA/CMA/2021/L.16. https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf (accessed Dec. 7, 2021).

5. International Energy Agency. *Global Energy Review 2019: The Latest Trends in Energy and Emissions in 2019*. April 2020. https://iea.blob.core.windows.net/assets/dc48c054-9c96-4783-9ef7-462368d24397/Global_Energy_Review_2019.pdf (current as of Jan. 25, 2022).

6. "EIA Projects Nearly 50% Increase in World Energy Usage by 2050, Led by Growth in Asia." September 24, 2019. https://www.eia.gov/todayinenergy/detail.php?id=41433 (current as of Jan. 25, 2022).

7. The Paris Agreement: https://unfccc.int/sites/default/files/english_paris_agreement.pdf (current as of Jan. 25, 2022).

8. Intergovernmental Panel on Climate Change. "Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development." Chapter 2 in: *Special Report: Global Warming of 1.5°C*. 2018. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf (current as of Jan. 25, 2022).

9. International Energy Agency. *World Energy Outlook 2020*. Box 4.1, p. 130. October 2020. https://iea.blob.core.windows.net/assets/a72d8abf-de08-4385-8711-b8a062d6124a/WEO2020.pdf.

10. "Accelerating the decarbonisation of the electricity mix is the single most important lever available to policy makers: it closes more than one-third of the emissions gap between the APS [pledged reductions] and NZE [Net Zero Emissions by 2050 Scenario]." Quotation from: International Energy Agency. *World Energy Outlook 2021*. Executive Summary, p. 17. December 2021. https://www.iea.org/reports/world-energy-outlook-2021/executive-summary (current as of Jan. 25, 2022).

11. International Atomic Energy Agency. *Nuclear Energy for a Net Zero World*. September 2021. https://www.iaea.org/sites/default/files/21/10/nuclear-energy-for-a-net-zero-world.pdf (current as of Jan. 25, 2022).

12. For example, see: D. Aas et al. "Pacific Northwest Zero-Emitting Resources Study." January 13, 2020. https://www.ethree.com/wp-content/uploads/2020/02/E3-Pacific-Northwest-Zero-Emitting-Resources-Study-Jan-2020.pdf (current as of Jan. 25, 2022).

13. International Energy Agency. *Projected Costs of Generating Electricity 2020*. December 2020. https://www.iea.org/reports/projected-costs-of-generating-electricity-2020 (current as of Jan. 25, 2022).

14. Nuclear for Climate. "Net Zero Needs Nuclear." 2021. https://www.euronuclear.org/wp-content/uploads/2021/02/COP26-Position-Paper.pdf (current as of Jan. 25, 2022).

15. Declaration from Nuclear Societies. May 13, 2019. Juan-Les-Pins, France. http://insc.ans.org/docs/Declaration_from_Nuclear_Societies_051319.pdf (current as of Jan. 25, 2022).

16. International Energy Agency. *World Energy Outlook 2021*. Table A.1a, "World energy supply," p. 294. https://www.iea.org/reports/world-energy-outlook-2021 (current as of Jan. 25, 2022).

17. International Energy Agency. *World Energy Outlook 2021*. https://www.iea.org/reports/world-energy-outlook-2021 (current as of Jan. 25, 2022).

18. U.S. Department of Energy, Office of Nuclear Energy. "Next-Gen Nuclear Plant and Jobs Are Coming to Wyoming. November 16, 2021. https://www.energy.gov/ne/articles/next-gen-nuclear-plant-and-jobs-are-coming-wyoming (current as of Jan. 25, 2022).

19. "NuScale and Nuclearelectrica Reach Agreement at COP26 to Initiate the Deployment of the First Small Modular Reactor in Europe." November 4, 2021. https://newsroom.nuscalepower.com/press-releases/news-details/2021/NuScale-and-Nuclearelectrica-Reach-Agreement-at-COP26-to-Initiate-the-Deployment-of-the-First-Small-Modular-Reactor-in-Europe/default.aspx (current as of Jan. 25, 2022).

20. World Nuclear Association. "Nuclear's Contribution to Achieving UN Sustainable Development Goals." October 2021. https://www.world-nuclear.org/sustainable-development-goals-and-nuclear.aspx (current as of Jan. 25, 2022).

21. U.S. Energy Information Administration. "Electricity Explained." https://www.eia.gov/energyexplained/electricity/ (current as of Jan. 25, 2022).

22. U.S. Energy Information Administration. "U.S. Energy Facts Explained." https://www.eia.gov/energyexplained/us-energy-facts/ (current as of Jan. 25, 2022).

23. U.S. Energy Information Administration. "Net Generation, United States, All Sectors, Monthly." https://www.eia.gov/electricity/data/browser/ (current as of Jan. 25, 2022).

24. Union of Concerned Scientists. *The Nuclear Power Dilemma: Declining Profits, Plant Closures, and the Threat of Rising Carbon Emissions*. October 9, 2018. https://www.ucsusa.org/resources/nuclear-power-dilemma (current as of Jan. 25, 2022).

25. U.S. Energy Information Administration. "State Energy Consumption Estimates 1960 Through 2019." Table CT8 for Vermont, p. 495. June 2021. https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf (current as of Jan. 25, 2022).

26. Institute for Energy Research, "New England Using More Natural Gas Following Vermont Yankee Closure." January 20, 2016. https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/new-england-using-more-natural-gas-following-vermont-yankee-closure/ (current as of Jan. 25, 2022).

27. U.S. Energy Information Administration. "State Energy Consumption Estimates 1960 Through 2019." Table CT8 for California, p. 85. June 2021. https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf (current as of Jan. 25, 2022).

28. U.S. Energy Information Administration. "State Energy Consumption Estimates 1960 Through 2019." Table CT8 for Florida, p. 135. June 2021. https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf (current as of Jan. 25, 2022).

29. U.S. Energy Information Administration. "New York's Indian Point Nuclear Power Plant Closes After 59 Years of Operation." April 30, 2021. https://www.eia.gov/todayinenergy/detail.php?id=47776 (current as of Jan. 25, 2022).

30. Brattle Group. *The Impacts of Illinois Nuclear Power Plants on the Economy and the Environment*. September 2019. https://www.brattle.com/wp-content/uploads/2021/05/17147_the_impacts_of_illinois_nuclear_power_plants_on_the_economy_and_the_environment.pdf (current as of Jan. 25, 2022).

31. American Nuclear Society. *Nuclear in the States Toolkit Version 2.0: Policy Options for States Considering the Role of Nuclear Power in Their Energy Mix*. June 2016. https://www.ans.org/file/5745/ANS-NIS-Toolkit-V2.pdf (current as of Jan. 25, 2022).

32. American Nuclear Society. Position Statement #26: "U.S. Commercial Nuclear Power Plants: A Vital National Asset." April 2017. http://cdn.ans.org/pi/ps/docs/ps26.pdf (current as of Jan. 25, 2022).

33. Germany released 0.15 megatons (MT) of CO_2 per terajoule (TJ) compared to France's 0.05 MT-CO_2/TJ. Source: International Energy Agency. "Countries and Regions." https://www.iea.org/countries (accessed Oct. 2021).

34. European Commission. "Electricity Price Statistics." https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_household_consumers (accessed Oct. 2021).

35. European Commission. "Greenhouse Gas Emissions Per Capita." https://ec.europa.eu/eurostat/databrowser/view/t2020_rd300/default/table?lang=en (accessed Oct. 2021).

36. Massachusetts Institute of Technology. *The Future of Nuclear Energy in a Carbon-Constrained World: An Interdisciplinary MIT Study*. 2018. https://energy.mit.edu/research/future-nuclear-energy-carbon-constrained-world/ (current as of Jan. 25, 2022).

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